Claims

1. A process for selectively hydrogenating C_2-C_{10} acetylenes and diolefins in an olefin production plant comprising the steps of, in sequence

(1) passing an olefin plant feed stream through a mixed phase hydrogenation reactor [24] to mixed phase-hydrogenate at least a portion of the C_2-C_{10} acetylenes and diolefins;

(2) passing the effluent from the mixed phase hydrogenation reactor [24] through a front depropanizer [27] to separate into a vapor stream rich in C_3 and lighter components and a liquid stream rich in C_4 and heavier components; or passing the effluent from the mixed phase hydrogenation reactor [24] through a front deethanizer [27] to separate into a vapor stream rich in C_2 and lighter components and a liquid stream rich in C_3 and heavier components;

(3) passing the vapor stream from step (2) through the vapor phase hydrogenation reactor [33] to vapor phase hydrogenate; recycling a portion of the C_4-C_{10} process stream to the mixed phase hydrogenation reactor [24], and passing the other portion to the downstream separation zones; and

(4) passing the effluent from the vapor phase hydrogenation reactor [33] to further separation zones.

2. A process as claimed in claim 1, wherein said olefin plant feed stream is derived from the process stream of a steam pyrolysis facility or a catalytic cracking facility.

3. A process as claimed in claim 1, wherein said olefin plant feed stream

comprises hydrogen, methane, carbon monoxide, acetylene, ethylene, ethane, propylene, propane, propyne, propadiene, butenes, butyne, 1, 3-butadiene, butane, C_5 nonaromatics, C_6 nonaromatics, C_7 nonaromatics, C_8 nonaromatics, benzene, toluene, styrene, or the mixtures thereof.

4. A process as claimed in claim 1, wherein said front depropanizer [27] or front deethanizer [27] operates at a pressure ranging from 0.5 MPa to 4.0 MPa.

5. A process as claimed in claim 1, wherein said mixed phase hydrogenation reactor operates at a temperature from 10℃ to 90℃ and a pressure of from 0.7 MPa to 4.0 MPa, in the presence of a mixed phase hydrogenation catalyst comprising Group VIII metal or Group IB metal.

6. A process as claimed in claim 5, wherein said mixed phase hydrogenation catalyst comprises one or more components selected from the group consisting of Palladium, Ruthenium, Platinum, and Nickel arsenide that is carried on a support and the support is selected from the group consisting of titanium oxide, silicon oxide, aluminum oxide, zinc oxide, tin oxide, molecular sieve, or mixtures thereof.

7. A process as claimed in claim 6, wherein said mixed phase hydrogenation catalyst also includes a promotor selected from the group consisting of potassium, sodium, lithium, calcium, magnesium, barium, copper, silver, gold, zinc, lanthanum, cerium, molybdenum, tungsten, antimony, arsenic, bismuth, vanadium, and the mixtures thereof.

8. A process as claimed in claim 1, characterized in that recycling a portion of the liquid stream of step (2) to the mixed phase hydrogenation

reactor [24], and passing the other portion to debutanizer or depropanizer.

9. A process as claimed in claim 1, wherein said vapor phase hydrogenation reactor operates at a temperature from 30℃ to 200℃ and a pressure of from 0.6MPa to 4.0MPa, in the presence of a Group VIII metal-containing hydrogenation catalyst.

10. A process as claimed in claim 9, wherein said vapor phase hydrogenation catalyst contains one or more components selected from the group consisting of palladium, ruthenium, platinum and nickel arsenide that is carried on a support and the support is selected from the group consisting of titanium oxide, silicon oxide, aluminum oxide, zinc oxide, tin oxide, molecular sieve and the mixtures thereof.

11. A process as claimed in claim 1, wherein said vapor phase hydrogenation catalyst further includes a promotor selected from the group consisting of potassium, sodium, lithium, calcium, magnesium, barium, copper, silver, gold, zinc, lanthanum, cerium, molybdenum, tungsten, antimony, arsenic, bismuth, vanadium, and the mixtures thereof.

12. A process as claimed in claim 1, wherein said further separation zones include demethanizer, deethanizer and the separation zone of the mixtures thereof.

13. A process for selectively hydrogenating C_2-C_{10} greater unsaturated hydrocarbons in an olefin production plant comprising the following steps:

a. passing an olefin-containing feed stream through a heat exchanger [23], to cool said feed stream to 10-90℃;

b. passing the process stream from step (a) through the mixed phase hydrogenation reactor [24];

c. Selectively hydrogenating at least a portion of the greater unsaturated hydrocarbons in the process stream entering the mixed phase hydrogenation reator [24];

d. passing the effluent from the mixed phass hydrogenation reactor [24] in step [c], through coolers [25], [26] to cool said effluent;

e. passing the cooled process stream through the front depropanizer [27], to separate into a vapor stream rich in C_3 and lighter components, and a liquid stream rich in C_4 and heavier components, front depropanizer [27] operating at a pressure ranging from 0.5 MPa to 2.0 MPa; or passing the cooled process stream through front deethanizer [27], to separate into a vapor stream rich in C_2 and lighter components, and a liquid stream rich in C_3 and heavier components, the front deethanizer [27] operating at a pressure ranging from 2.5 MPa to 4.0 MPa;

f. passing the vapor phase rich in C_3 and lighter components through the vapor phase hydrogenation reactor [33], to selectively hydrogenate all the residual acetylene, propyne, propadiene; or passing the vapor phase rich in C_2 and lighter components through the vapor phase hydrogenation reactor [33], to selectively hydrogenate the residual acetylene; recycling a portion of the liquid stream to mixed phase hydrogenation reactor [24], the other portion to debutanizer or depropanizer;

g. cooling and partially condensing the vapor phase process stream from

the vapor phase hydrogenation reactor, and recycling the condensed process stream as reflux liquid to the top of the front depropanizer [27]or front deethanizer [27];

h. passing the vapor phase stream from step (g) to the downstream separation zones for the removal of methane, ethane, or the mixtures thereof.